

## **REMARKS**

### **Summary of Abstract and Specification Amendments**

The Specification and the Abstract have been amended to fix typographical errors. No new matter has been added.

### **COMMENTS**

As noted by Examiner in the pending Office Action and as will be appreciated by one skilled in the arts, the referred to "acid salts" and "acid salt solution" are known to be inorganic, i.e. not a compound containing carbon. This clarification is made throughout the specification as described below.

Typographical errors were corrected in paragraphs [0061], [0060], [0033], [0032], [0021], [0019], [0018], [0017], and [0014] where the word "organic" was changed to "inorganic" to properly reflect the intended and described chemical composition. The use of the word "organic" occurs in two cases throughout the specification where an "inorganic" composition is described and intended: 1) as a salt other than lithium (Li) and 2) as a salt solution. In each case, the molecule mixed is inorganic as it does not contain carbon (C). It is apparent by the context around the mistranslated word that an "inorganic" salt or "inorganic" salt solution was intended as it is the only reasonable meaning here, as pointed out by Examiner.

#### **Type 1 – Inorganic acid salt**

Paragraphs [0019], [0021], [0033], and [0061] state an "organic" acid salt where an "inorganic" acid salt is described and intended. However, as pointed out by the Examiner and as will be appreciated by one skilled in the arts, the referred to "acid salt" is known to be inorganic. These typographical errors and the corresponding corrections are readily apparent from the context surrounding the acid salt. Paragraph [0019] explains that the acid salt may be chosen from any salt capable of producing  $\text{Li}_{1+x}(\text{Ni}_{1/2}\text{Mn}_{1/2})\text{O}_2$  and  $\text{Li}_{1+x}(\text{Ni}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3})\text{O}_2$ , where each element in the chemical composition is other than carbon (C), thus making the salt inorganic. Furthermore, claim 2 describes the acid salts to be of the inorganic group consisting of Al, Co, Cr, Fe, Ni, Mn, Mg, Cu and Sb. Additionally, the use of inorganic compounds is apparent and supported in Examples 1-4. Therefore, Applicant requests that the typographical errors be corrected.

Type 2 – Inorganic acid salt solution

Paragraphs [0014], [0017], [0019], [0032], [0060] state that an "organic" acid salt solution of metal elements constituting a final composite oxide other than lithium is subjected to spray pyrolysis. However, as pointed out by the Examiner and as will be appreciated by one skilled in the arts, the referred to "acid salt solution" is known to be inorganic. These typographical errors and the corresponding corrections are readily apparent from the context surrounding the acid salt solution. For example, paragraph [0017] explains that the acid solution is a mixture of one of a subset of non-carbon metals (Al, Co, Cr, Fe, Mn, Ni, Mg, Cu and Sb) mixed with, for example, combinations of  $\text{NO}_3$  and  $\text{H}_2\text{O}$  as detailed in paragraph [0018], or combinations of  $\text{NO}_3$ ,  $\text{H}_2\text{O}$ , and Co, as detailed in paragraph [0019]. Indeed, the acid salt is limited in paragraph [0019] to any "acid salts capable of producing ...  $\text{Li}_{1+x}(\text{Ni}_{1/2}\text{Mn}_{1/2})\text{O}_2$  and  $\text{Li}_{1+x}(\text{Ni}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3})\text{O}_2$ ", where that final chemical structure is inorganic. Additionally, the use of inorganic compounds is readily apparent and supported in Examples 1-4. Therefore, Applicant requests that the typographical errors be corrected.

Typographical errors were corrected in paragraphs [0015], [0033], [0060], and [0061] where "an organic acid" salt was changed to "a hydroxide" salt to properly reflect the described and intended chemical composition. These typographical errors and the corresponding corrections are readily apparent from the context surrounding the acid salt as described in paragraphs [0008], [0009], [0039], and [0051]. For example, paragraph [0009] states that "a lithium salt ...e.g. ... lithium hydroxide" is used in spray pyrolysis, where the lithium salt is further described in paragraphs [0039] and [0051] as "lithium hydroxide dihydrate ( $\text{LiOH} \cdot 2\text{H}_2\text{O}$ ).". Therefore, Applicant requests that these typographical errors be corrected.

**Summary of Claim Amendments**

Claims 1-14 were pending in this application prior to entry of this amendment, Claims 15 and 16 were previously withdrawn and Claims 1-14 have been currently rejected. Claims 1, 2, 3, 4, 6, 7, 9, 10, 11, and 12 are amended herein. No new matter has been added.

Reconsideration and withdrawal of the rejections set forth in the Office Action dated October 2, 2009, are respectfully requested.

**Rejections under 35 U.S.C. §112, second paragraph**

Claims 1-14 were rejected under 35 U.S.C. §112, second paragraph as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which is regarded as the invention.

**COMMENTS**

Applicant would like to request the Examiner's reconsideration of the rejection based on the amended claims and in view of the following.

Claim 1 was rejected based on the word "process" within the phrase, "a spray pyrolysis process", allegedly making the claim indefinite. Applicant would like to request the Examiner's reconsideration based on the amended claim 1 where "process" has been omitted.

Claims 1-4, and claim 7 were rejected based on the word "organic" within the phrase, "organic acid salt solution", allegedly making these claims indefinite. Applicant would like to request the Examiner's reconsideration based on the amended claims 1-4 and claim 7 where "organic" has been replaced with "inorganic". As detailed above in the commentary regarding amending the Specification, these changes are to correct typographical errors and do not consist of new matter.

Claim 1 was rejected based on the words "organic acid" within the phrase, "organic acid salt of lithium", allegedly making the claim indefinite. Applicant would like to request the Examiner's reconsideration based on the amended claim 1 where "an organic acid" has been replaced with "a hydroxide". As detailed above in the commentary regarding amending the Specification, this change is to correct a typographical error and does not consist of new matter.

Claims 6, 9, and 10 were rejected based on the parentheses around the "wherein" clause allegedly making these claims indefinite. Applicant would like to request the Examiner's reconsideration based on the amended claims 6, 9 and 10 where the parentheses have been omitted.

Claim 11 was rejected based on the phrase "the step of forming the intermediate composite oxide" allegedly lacking proper antecedent basis. Applicant would like to request the

Examiner's reconsideration based on the amended claims 1 and 11 where "intermediate composite oxide powder" has been claimed.

Claim 12 was rejected based on the acronym "PVA" allegedly being indefinite for what it is or represents. Applicant would like to request the Examiner's reconsideration based on the amended claim 12 where "PVA" has been replaced with "polyvinyl acetate".

Therefore, based on the remarks made above, Applicant requests the Examiner's reconsideration of the rejection based on 35 U.S.C. §112.

### **Rejections under 35 U.S.C. §103**

Claims 1-14 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Yamashita '786 or Japan 12-149923.

### **COMMENTS**

#### **Overview**

Applicant would like to request the Examiner's reconsideration of the rejection based on the amended claims and in view of the following.

In regards to *Yamashita '786* and *Japan 12-149923*, the Examiner claims that these references "suggest the instantly claimed process of spray pyrolysis of nitrate solutions of metals such as manganese, cobalt or nickel and mixing with lithium formate, i.e. organic acid salt of lithium, and heating". Examiner further suggests that these references demonstrate such steps in their examples.

Applicant argues that, unlike said references, Applicant claims 1) an "inorganic" not "organic" acid salt solution, 2) said inorganic salt solution used in spray pyrolysis must not contain lithium, and 3) "mixing" occurs a) using solid-state mixing of b) non-lithium oxide powder with hydroxide salt of lithium c) only after said spray pyrolysis. Therefore, Applicant believes the references to be inapplicable and respectfully requests the Examiner's reconsideration of the rejection.

Yamashita '786

*Yamashita '786* provides for a "solution of organic acid salts ... constituting the complex oxide ... and decomposing the solution by spray pyrolysis" (Claim 1); therefore, *Yamashita '786* describes a process of using an organic, mixed, lithium-based solution in the spray pyrolysis step.

First, Applicant is claiming an "inorganic" acid solution and not an organic solution as described in *Yamashita '786*. Applicant's amended claim 1 states that the "an *inorganic* acid salt solution" (emphasis added) is subjected to spray pyrolysis. However, claim 1 in *Yamashita '786* states that a "solution of *organic* acid salts" (emphasis added) is decomposed by spray pyrolysis. Indeed the examples of *Yamashita '786*, example 1 at (Col 5:lines 36-40), example 2 at (Col 5:lines 33-45), and example 3 at (Col 9:lines 33-44), cited by the Examiner, each describe an "organic" acid solution. Therefore, Applicant respectfully requests the Examiner's reconsideration of the rejection.

Second, Applicant's claim 1 describes a composite oxide used in spray pyrolysis to be a material "other than lithium"; however, *Yamashita '786* clearly describes its complex oxide, which is subjected to spray pyrolysis, to contain lithium. The use of lithium in spray pyrolysis is found throughout *Yamashita '786*.

In its Abstract, *Yamashita '786* distinctly points out that "a complex oxide containing at least lithium ... is subjected to spray pyrolysis." In the Summary Of the Invention, *Yamashita '786* describes a method of producing a lithium secondary battery, in part, by decomposing a collection of complex oxides. *Yamashita '786* further limits this collection by defining its members to each be "one selected from the group consisting of  $\text{LiMn}_2\text{O}_4$ ,  $\text{LiCoO}_2$  and  $\text{LiNiO}_2$ ", where each complex contains lithium (Li). Only the *non*-Li element within each group member is interchangeable. Unlike Applicant's innovation, these lithium-based complex oxides are then decomposed by spray pyrolysis. The necessary presence of lithium in the solution, used in spray pyrolysis, is further evident in the examples cited by the Examiner.

Example 1 describes mixing "1.0 mol of lithium formate or lithium nitrate" into a solution where "each of the mixed solutions [is] subjected to the spray pyrolysis." In fact, lithium is necessary in this example as it could not be omitted or replaced in that invention to have the same effect. (Col 5:41-45).

Example 2 also describes mixing "1.0 mol of lithium formate or lithium nitrate" into a solution where "[e]ach of the mixed solutions [is] subjected to spray pyrolysis by spraying it from a nozzle into a heat-pyrolysis furnace." Also as in Example 1, lithium is necessary in this example as it could not be omitted or replaced in that invention to have the same effect as described in the example. (Col 7:lines 46-50).

Example 3 similarly describes mixing "1.0 mol of lithium formate or lithium nitrate" to a mixture where "the mixed solution [is] then subjected to spray pyrolysis." Again, as in Example 1 and Example 2, lithium is necessary in this example as it could not be omitted or replaced in that invention to have the same effect as described in the example. (Col 9:lines 45-50).

Therefore, Applicant respectfully requests the Examiner's reconsideration of the rejection.

Third, Applicant's amended claim 1 reads, "solid state-mixing the intermediate composite oxide powder [(the product of spray-pyrolysis)] and a hydroxide salt of lithium." Therefore, Applicant uses: a) solid state-mixing of, b) a non-lithium material with a hydroxide salt of lithium, c) only after the spray-pyrolysis step. However, *Yamashita '786* uses "mixing" wholly different than Applicant in the a) type of mixing used, b) the products mixed, and c) the timing of the mixing.

In *Yamashita '786*, solid-state mixing is not utilized. Mixing appears to simply be adding lithium-based "organic acid salt in combination with material which releases oxygen" (Col 2:lines 37-42); dissolving said salt combination with a liquid mixture as detailed in Example 1 (Col 3:lines 15-30), Example 2 (Col 5:lines 61-6:8) and Example 3 (Col 8:lines 3-11); or "adding a material generating oxygen to [this] aqueous or alcohol solution comprising organic acid salts" (Col 2:lines 52-59). Therefore, this reference is not using solid-state mixing as utilized by the Applicant.

Furthermore, *Yamashita '786* "mixes" materials other than Applicant's i) non-lithium, inorganic material and a ii) hydroxide salt of lithium. As stated above, *Yamashita '786* mixes i) organic, lithium and non-lithium-based material, ii) a material generating oxygen, with iii) an aqueous or alcohol solution. Therefore, this reference is mixing materials of a different type than that of the Applicant.

Lastly, *Yamashita '786*, "mixes" its materials at a critically different time in the process than that used by the Applicant. Whereby Applicant solid-state mixes the non-lithium material

with the hydroxide salt of lithium *after* spray pyrolysis, in *Yamashita '786* the lithium-based "solution is heat-decomposed by the spray pyrolysis to form powder of the complex oxide" from its solution (Col 2:lines 52-57). Contrarily, Applicant uses solid state-mixing only *after* spray pyrolysis and *Yamashita '786* uses *non-solid-state-mixing before* spray pyrolysis. Therefore, this reference is "mixing" materials at a different stage than that of the Applicant, and not using solid state-mixing.

Therefore, the Applicant respectfully requests the Examiner's reconsideration of this rejection based on *Yamashita '786*.

Japan 12-149923

*Japan 12-149923* claims a process of using a mixed, lithium-based solution in the spray pyrolysis step. The method claims of claim 2 and claim 3 each provide that "a lithium-nickel composite oxide" is manufactured by adding "to a basic metal salt ... within an aqueous medium ... a lithium compound [that] is spray- or freeze-dried and then baked."

First, Applicant's claim1 subjects a composite oxide "other than lithium" to spray pyrolysis while *Japan 12-149923* clearly describes its composite oxide, subjected to spray pyrolysis (spraying, drying and then baking), to contain lithium.

*Japan 12-149923* repetitiously describes the use of lithium in the spray pyrolysis throughout the application by explaining that the "lithium-nickel composite oxide of the present invention can be obtained by ... adding, to a basic metal salt ... within an aqueous medium, a lithium compound ... and by spray- or freeze-drying and the backing the obtained slurry" (0014-0015). In fact, spray drying the lithium is preferred as *Japan 12-149923* goes on to state that "it is desirable for the [lithium-based] slurry to... to be dried based on the spray ... method ...due to the migration of lithium to the surface" (0022-0023).

Furthermore, the examples cited by the Examiner only go to reinforce that this reference, unlike Applicant's innovation, uses lithium in spray pyrolysis. Example 1, 2, and 4 each state that "[a]fter a 3.0 M aqueous lithium hydroxide solution has been added ... the obtained mixture was spray-dried ... and then baked" (0042), (0046), (0049). Clearly, lithium is part of the spray and baking process, whereas, Applicant distinctly claims a process where lithium is not used in the spray and baking process. Therefore, Applicant respectfully requests the Examiner's reconsideration of the rejection.

Second, Applicant's amended claim 1 reads, "solid state-mixing the intermediate composite oxide powder[, the product of spray-pyrolysis,] and a hydroxide salt of lithium." Therefore, Applicant uses solid state-mixing of a) a non-lithium material with a hydroxide salt of lithium, b) only after the spray-pyrolysis step. However, *Japan 12-149923* uses "mixing" wholly different than Applicant in the a) products mixed, and b) timing of the mixing.

In *Japan 12-149923*, solid-state mixing is not utilized to combine a non-lithium material with a hydroxide salt of lithium. Examiner's closest reference may be that *Japan 12-149923* uses "press-molding [of] a spray-dried product obtained by the aforementioned spray dry method" (0027). The "spray-dried product" stated here is the lithium-based "slurry" discussed above; therefore, it is not "solid state-mixing ...[non-lithium] oxide powder and a hydroxide salt of lithium" as claimed by Applicant. Thus, the products mixed or "pressed" in *Japan 12-149923* are not equivalent to that of the Applicant.

Next, *Japan 12-149923* mixes its materials at a critically different time in the process than that used by the Applicant. Applicant solid state-mixes the non-lithium material with the hydroxide salt of lithium to physically form the new lithium composite oxide. *Japan 12-149923* uses "press-molding [of] a spray-dried product obtained by the aforementioned spray dry method" (0027) and, therefore, performs this task *after* the lithium composite oxide has been formed. Therefore, this reference is mixing materials at a different stage than that of the Applicant.

Lastly, the arguments listed under *Yamashita '786* are also made here where *Japan 12-149923* mixes or dilutes, without using solid state-mixing, one material with an aqueous or alcohol solution.

Therefore, the Applicant respectfully requests the Examiner's reconsideration of this rejection based on *Japan 12-149923*.

#### Dependent Claims

In view of the above remarks, a specific discussion of every dependent claim is considered to be unnecessary. Therefore, Applicants' silence regarding any dependent claim is not to be interpreted as agreement with, or acquiescence to, the rejection of such claim or as waiving any argument regarding that claim.

**CONCLUSION**

Based on these amendments to the claims and arguments listed above, Applicant respectfully requests the Examiner's reconsideration of rejections made in this latest correspondence.

If the Examiner believes that a conference would be of value in expediting the prosecution of this application, he is cordially invited to telephone the undersigned counsel at (650) 838-4361 to arrange for such a conference. Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 50-2207, under Order No. 58877-8004.US01 from which the undersigned is authorized to draw.

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Respectfully submitted,

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